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U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
WASHINGTON, D. C.
H. H. BENNETT, CHIEF

Watershed and Hydrologic Studies

INSTRUCTIONS FOR THE INSTALLATION OF
WATER LEVEL RECORDERS, FRIEZ TYPE FW.- 1

Prepared by D. B. Krimgold, John L. Weber and
L. L. Harrold, under the direction of C. E. Ramser,
In Charge, Watershed and Hydrologic Studies

January 1938
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United States
Department of
Agriculture



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FRIEZ WATER STAGE RECORDER TYPE FW

PUBLISHED BY JULIEN P. FRIEZ & SONS, INC.

PUBLISHED BY JULIEN P. FRIEZ & COMPANY
BELFORT OBSERVATORY, BALTIMORE, MD., U.S.A.

WATER STAGE RECDRD FOR *Sta. W-1 (J. Doe Farm) Ohio-5, York, Ohio.*

WATER STAGE RECDRD FOR St. Lawrence 1937 11 11
BEGINNING DATE Nov. 10/37 TIME 9:00 A.M. STAFF GAGE READING 10.0

ENDING DATE *Nov. 10/37* TIME *3:00 P.M.* STAFF GAGE READING
STAGE HEIGHT RATIO: 5" DF CHART = *12" of* WATER

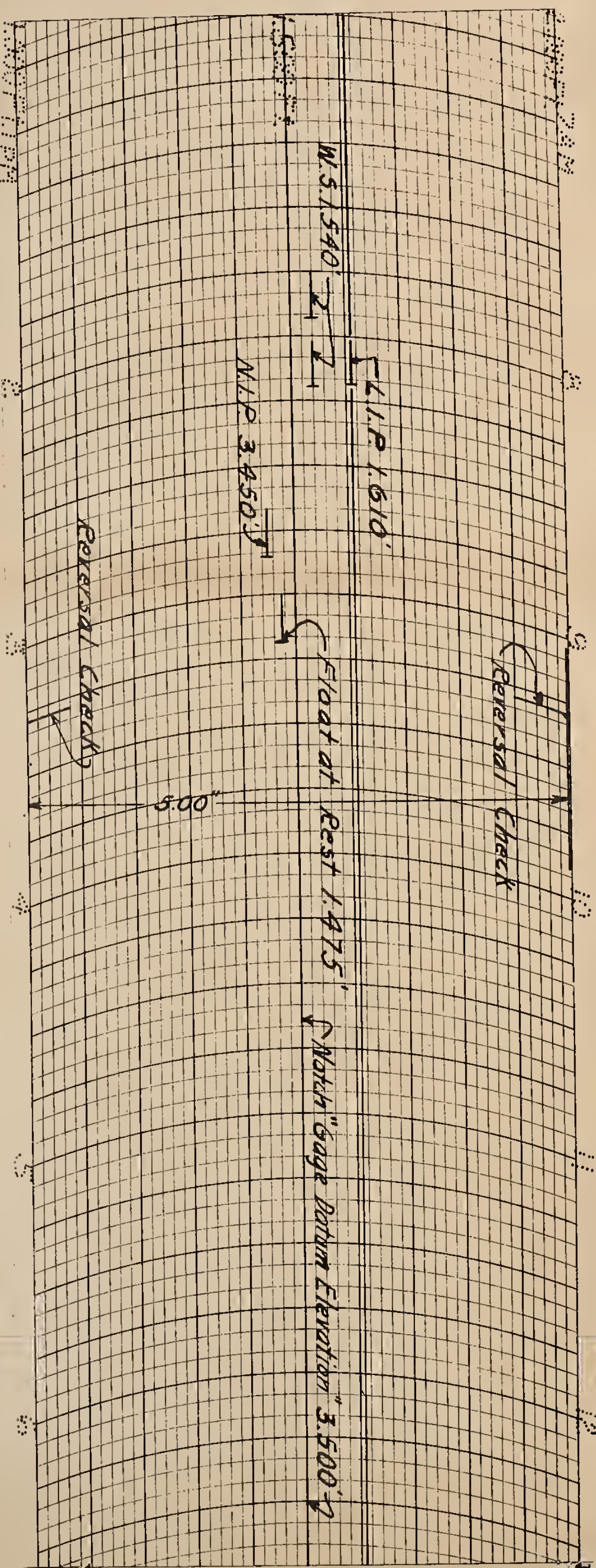
STAGE HEIGHT RATIO: 5 OF CHART = 7.44

CHECK THE TIME SCALE USED

1 DIVISION	5 MINUTES (6 HOUR CHART)	<input checked="" type="checkbox"/>
1 DIVISION	10 MINUTES (12 HOUR CHART)	<input type="checkbox"/>
1 DIVISION	20 MINUTES (24 HOUR CHART)	<input type="checkbox"/>

CHART CHANGED BY *J.C. Smith*

CHART CHANGED BY *J.C. Smith*
REMARKS *Recorder Installation*



INSTRUCTIONS FOR THE INSTALLATION OF WATER
LEVEL RECORDERS, FRIEZ TYPE FW-1

Prepared by
D. B. Krimgold, John L. Weber, and L. L. Harrold

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INTRODUCTION

These instructions are not an authorization to proceed with the installation of any water level recorders. Authorization to proceed with the installation will be given after the information called for below is received by the Washington office.

I. UNPACKING, INSPECTION, AND PREPARATION

The operations outlined in Steps 1 to 8 are to be performed in the office or warehouse before proceeding to the field. The recorder and appurtenances are shipped in a carton containing the following items:

- An envelope containing the manufacturer's instructions.
- A package containing the float.
- A package containing the clock with pinion attached and the chart clip.
- A cardboard box containing: #1940 charts, counter weight, graduated steel float tape, bottle of ink, two tape clamps with rings and two sets of gears and pinions.
- A package containing the recorder with clock gear and clock shaft attached.

STEP 1. Read the attached "Manufacturer's Instructions" carefully, remove the contents of the carton and unwrap the packages.

STEP 2. Check the items listed above and advise the Washington office concerning the following:

1. Condition of recorders and clocks.
2. Missing parts.
3. Were #1940 charts found with each recorder and how many?
4. Was a chart box found with each recorder?
5. Give the numbers of the gears and pinions found with each of the recorders.
6. Were graduated float tapes found with each of the recorders?
7. Were sufficient enameled staff gage sections graduated to 0.02' received by the project?
8. Have the brass bench marks (2 for each weir) been received and installed?
9. Are the field books referred to in these instructions available for each station? Directions for the use of these books are given on the inside of the front covers.

10. Have the brass screws, washers and picture hooks been received?
11. Will all the items listed in Step 7 on page 3 be available on the project at the time of installation?

Upon receipt of this information missing parts will be supplied and damaged clocks and instruments will be replaced.

STEP 3. Wind the clock in accordance with the "Manufacturer's Instructions." If it is not running after gently shaking the cylinder, replace it with a spare clock or a clock from another recorder not in use.

STEP 4. Make sure that the proper gear and pinion for a 6-hour time scale are attached to the clock shaft on the recorder and to the clock. If this is not the case, make the necessary "clock gear change" in accordance with pages 2 and 3 of the "Manufacturer's Instructions."

STEP 5. Following the sample chart shown on page 17, make the proper entries with black India ink on the heading of a #1940 chart and label the graduations as shown in dotted lines in the body of the sample chart. (Dotted lines are used on the sample chart to indicate all entries which are to be the same for all stations. Solid black lines should be used in making all entries.)

Draw a horizontal line on the chart exactly 5.00" from the lowest graduation line about 2" long at approximately correct time as shown on the sample chart. Indicate by arrows the 5.00" dimension.

Place the chart on the clock cylinder, making sure that entire lower edge of chart rests on flange of clock cylinder, and install clock on recorder in accordance with pages 1 and 2 of "Manufacturer's Instructions" to make sure that the gear and pinion mesh.

(Note: Whenever placing clock on, or removing it from the recorder, always do so by grasping the handle of the clock key. Refrain from grasping the top of the cylinder by thumb and fingers as this method will invariably cause the chart to slide up the cylinder away from the flange.)

Place one drop of ink in pen and check pen reversal as follows:

STEP 5-a. By rotating the float wheel bring the pen within 1/2" of the lower edge of the chart approximately below the left end of the 5.00" measured line. Place the pen on the chart and continue rotating the float wheel until the pen reverses. If this lower reversal occurs above or below the lowest graduation, bring it exactly to that line by means of screw "K". Make the upper reversal. In practically all cases this will occur on the measured 5.00" line, which will complete the pen reversal check.

If the upper reversal occurs below the 5.00" line, turn screw "K" counterclockwise until the pen rests on the 5" line. By

rotating the float wheel make the lower reversal. If it occurs above or below the lowest graduation, loosen the small set screw which fixes the pen arm on the shaft.

By holding the pen arm about at its mid-point in the left hand, and screw "M" with the right hand, change the position of the pen arm on the shaft so that the lower reversal will occur at the lowest graduation. Make the upper reversal. If it occurs on the 5.00" line, tighten the set screw and make a final check of both reversals.

(Note: If the first upper reversal made in Step 5-a should occur above the 5.00" line, the adjustment would be made as above except screw "K" would be turned clockwise instead of counterclockwise.)

Remove the clock.

STEP 6. Prepare recorder for transport to the field in accordance with page 4 of "Manufacturer's Instructions" and repack it, the clock, and appurtenances in the carton.

STEP 7. Assemble the items listed below to be taken to the field:

Recorder with appurtenances. Field book and a 4H pencil.

One set of enameled staff gage sections.

Two #8-2 $\frac{1}{2}$ " round head brass screws for fastening recorder to shelf.

Ten #8-1" round head brass screws for each section of staff gage to be installed.

Twelve brass washers for #8 screws to be used in fastening upper and lower ends of enameled gages when cut.

One 2 $\frac{1}{4}$ " brass picture hook to be used as pointer for tape setting.
(The end of the hook is to be filed to a sharp edge to facilitate accurate reading of tape.)

One good engineer's level.

One level rod with target.

One plumb bob with 20' cord.

One carborundum stone with 2" side.

One claw hammer.

One screw driver.

One brace.

One cutting pliers.

One 1" bit or auger.

One breast drill.

One drill for #8 screws.

One hacksaw.

One try-square.

One flat file.

STEP 7 (Continued).

One flashlight.
One round file.
A few 8d wire nails.
Two pails.
One 20' rope (sash cord or similar).
One pair of waders.
One handsaw.

A water tank with sufficient length of rubber hose for supplying water to stilling well. (About 50 gallons per ft. of depth of 36" well will be required).

One 25' steel tape graduated in one-hundredths of a foot (this is in addition to the graduated float tape).

STEP 8. Pack all instruments, tools, etc., and proceed to the field. The field party should consist of 3 men.

II. DETERMINATION OF "GAGE DATUM ELEVATION" OF NOTCH AND FLOAT REST RING.

For the purpose of measuring the head on the weir the elevation of the notch must be determined in terms of staff gage readings. This elevation will be referred to as "gage datum elevation". It will depend on the difference in elevation between the notch and the top of the float rest ring and will be determined in the following manner:

- STEP 1. Rub the notch with the carborundum stone to secure a flat level 2" surface through the 4" width of the crest at the notch if this surface is not sufficiently smooth.
- STEP 2. Set up the engineer's level in such a manner that readings can be taken on the outside staff gage support, a rod held on the notch of the weir, the float rest ring in the stilling well and if possible the permanent bench marks.
- STEP 3. With the instrument in adjustment and leveled take a back sight on the rod held on the 2" apex of the notch reading the target to within 0.001'. Take a foresight on the rod held on the ring (float rest) in the stilling well to within 0.001'. Compute the difference in elevation between the notch and the float rest. Repeat this operation and check to within 0.002'.

NOTE: If impossible to use level rod on float rest ring, a reading to within 0.01' using a rule or steel tape will be sufficient.

Determine the "gage datum elevation" of the notch from the table given below: Record this operation in the field book as shown on page 5.

Difference in Elevation be- tween notch & float rest ring	"Gage Datum Elevation" of notch	Difference in Elevation be- tween notch & float rest ring	"Gage Datum Elevation" of notch
0.38 to 0.50	1.500	4.51 to 5.00	6.000
0.51 to 1.00	2.000	5.01 to 5.50	6.500
1.01 to 1.50	2.500	5.51 to 6.00	7.000
1.51 to 2.00	3.000	6.01 to 6.50	7.500
2.01 to 2.50	3.500	6.51 to 7.00	8.000
2.51 to 3.00	4.000	7.01 to 7.50	8.500
3.01 to 3.50	4.500	7.51 to 8.00	9.000
3.51 to 4.00	5.000	8.01 to 8.50	9.500
4.01 to 4.50	5.500	8.51 to 9.00	10.000

- STEP 4: With the foresight on the float rest ring and the elevation of the notch determined in Step #3, compute the "gage datum elevation" of the float rest ring and record it as shown on page 5.

UNITED STATES

FIELD NOTES

PROJECT NO.	Ohio-5,	York, Ohio.	Town	State	STATION NO.	W-1	John Doe	farm (faneh)
DATE:	Nov. 11, 1937	WEATHER:	38° F.	Clear	Cloudy	Rain	Snow	Windy
Mo.	Day	Year	Calm			OBSERVER:	J. C. Smith	Name
(Cross out words not applying)								

SETTING WATER STAGE RECORDER. FW. TYPE. SERIAL NO. 163-33.

SETTING WATER STAGE RECORDER. FW. TYPE. SERIAL NO. 163-33.				
II. DETERMINATION OF "GAGE DATUM ELEVATION" OF NOTCH AND FLOAT REST RING.				
Sta.	BS.	H. I.	FS.	Diff. in Datum Elev.
Notch	2.852			2.223
Float Rest Ring			5.075	
Notch	2.853			2.224
Float Rest Ring			5.077	
From table in instructions "Gage Datum Elev." of Notch = 3.500 (II. Step 3).				
Notch	2.853	6.353		3.500 ✓
Float Rest Ring			5.077	1.276 ✓
Top of Ring (II. Step 4).				

III. SETTING OUTSIDE STAFF GAGES

CASE "A" (when only one outside gage is used)

- STEP 1. With the instrument carefully leveled again take a back-sight on the notch, reading the target to 0.001' (this should check the reading under Step #3 of II). This reading added to the "gage datum elevation" of the notch is the "H. I.".
- STEP 2. Take a foresight on the rod held on top of the right edge of the gage support reading the target to 0.001' and compute its elevation.
- (Note: If the top of the support is uneven the rod can be held on a nail driven into the top of the support.)
- STEP 3. With the graduated steel tape held at the top of the support (or the nail) reading the elevation obtained in Step #2, mark and label, (near the top, middle and bottom of each enameled section) several points on the right edge of the gage support with a sharp pencil. These points will be used to set the corresponding finer graduations of the enameled section and should be on even rather than odd hundreds, that is, 1.54 and not 1.53.
- STEP 4. With the try square and pencil extend the graduations of the enameled section, corresponding to those marked on the support, to the edge of the section. Place the enameled section against the labeled marks and attach it to the support with two screws. In most cases it will be necessary to cut off parts of the section with the hack saw.
- (Note: Where two sections must be used it will be found that in general they do not fit closely end to end for proper reading.)

- STEP 5. Check the readings on the gage against the notch by repeating Steps 1, 2, and 3, and place the remaining screws. Record these operations in the field book as shown on page 7.

CASE "B" (when more than one outside gage is used)

After completing the setting of the lower gage as outlined under Case "A", proceed in a similar manner in setting the higher gages. The support will, in general, be sufficiently high so that the H. I. can be marked on it. The several points mentioned in Step #3 can be marked and labeled by measuring with the graduated tape upwards and downwards from the H. I. mark.

(Note: Since graduated float tapes will be used the inside staff gages will not be installed until experience indicates a definite need for them.)

UNITED STATES
DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
WATERSHED & HYDROLOGIC STUDIES

FIELD NOTES

PROJECT NO. Ohio-5 York, Ohio STATION NO. W-I. John Doe farm (~~ranch~~)
 DATE: Nov. 11, 1937 WEATHER: 38°F. Clear Cloudy Rain Snow Windy Calm OBSERVER: J. C. Smith
No. Day Year (Cross out words not applying) Name

SETTING WATER STAGE RECORDER. FW. TYPE. SERIAL NO. 163-33.									
III. SETTING OUTSIDE STAFF		GAGES.		Gage Datum Elev.					
Sta.	RS.	H. I.	FS.						
Notch	2.853	6.353			3.500	(III. Step 1).			
O. G. #1			2.884		→ 3.469	Top of lower outside gage support (III. Step 2)			
						Points on right edge of support marked at			
						Elevations 3.14, 2.14 and 1.14 to set			
						enameled gage section (III. Step 3).			
Ground			5.40		0.95	Ground surface of outside gage #1; enameled section cut at 0.96 (III. Step 4).			
Notch	2.852	6.352			3.500	Enameled section checked with tape and found O.K. (III Step 5)			
O. G. #1			2.883		→ 3.469	Line on right edge of higher outside staff			
O. G. #2			0.000		→ 6.352	gage support (III. Case B). Points on right			
						edge of support marked at elevations 3.14,			
						4.14 and 5.14 to set enameled section; cut gage			
						section even with top of support.			
Notch	2.854	6.354			3.500				
O. G. #2			0.004		→ 6.350	This reading taken on tape held with an even			
						foot mark on previously marked H. I. line.			

IV. PLACING OF RECORDER

- STEP 1. Place the float on the float rest ring so that its axis is vertical. If the water surface in the stilling well is too close to the float rest, sufficient water should be withdrawn to permit the above operation.
- STEP 2. Mark the point corresponding to the center of the float on the underside of the shelter floor by means of a plumb bob held over the center of the float's lug.
- STEP 3. At the point marked in Step #2 drill a hole vertically through the shelter floor with the #8 drill, thus marking the center of the float rest ring on the shelter floor.
- STEP 4. Drill a 1" hole vertically through the shelter floor at the point marked in Step #3. This is the float side hole for the float tape.
- STEP 5. Place the recorder (without the clock) with the proper side of the float wheel approximately over the hole and rotate the recorder about the hole to determine the position at which the index pointer to be placed on float side of the wheel can be most conveniently read and at which the recorder can be conveniently serviced. Mark this position with a pencil along the front side of the recorder base and remove the recorder.
- STEP 6. Drill another 1" hole 3-3/4" center to center from the first one in the proper direction marked in Step #5.
- STEP 7. Set the float, with tape clamp attached, on the float rest ring.
- STEP 8. With the clock removed, set the recorder so that the float wheel is between the two holes. Loosen screws marked "E" (see diagram of "Manufacturer's Instructions") to allow the float wheel to revolve freely on its shaft. Place the graduated float tape on the float wheel with the zero end through the 1" hole drilled in Step #6.

STEP 9. Attach the counterweight to the extremity of the zero end of the tape so that the zero point on the tape is about 0.4' from top of clamp.

CAUTION: Do not cut the tape except as instructed below.

Rotate the float wheel until the tape reads the "gage datum elevation" of the float rest ring(*) plus 0.3' on the shelter floor at the float side hole. See sketch and note on page 10, for explanation of the tape reading used in this Step.

With the float tape held at this position, attach the tape to the float clamp and cut off the excess tape leaving about one extra foot for final adjustments. Be sure the float is resting on the knobs of the ring when this is done.

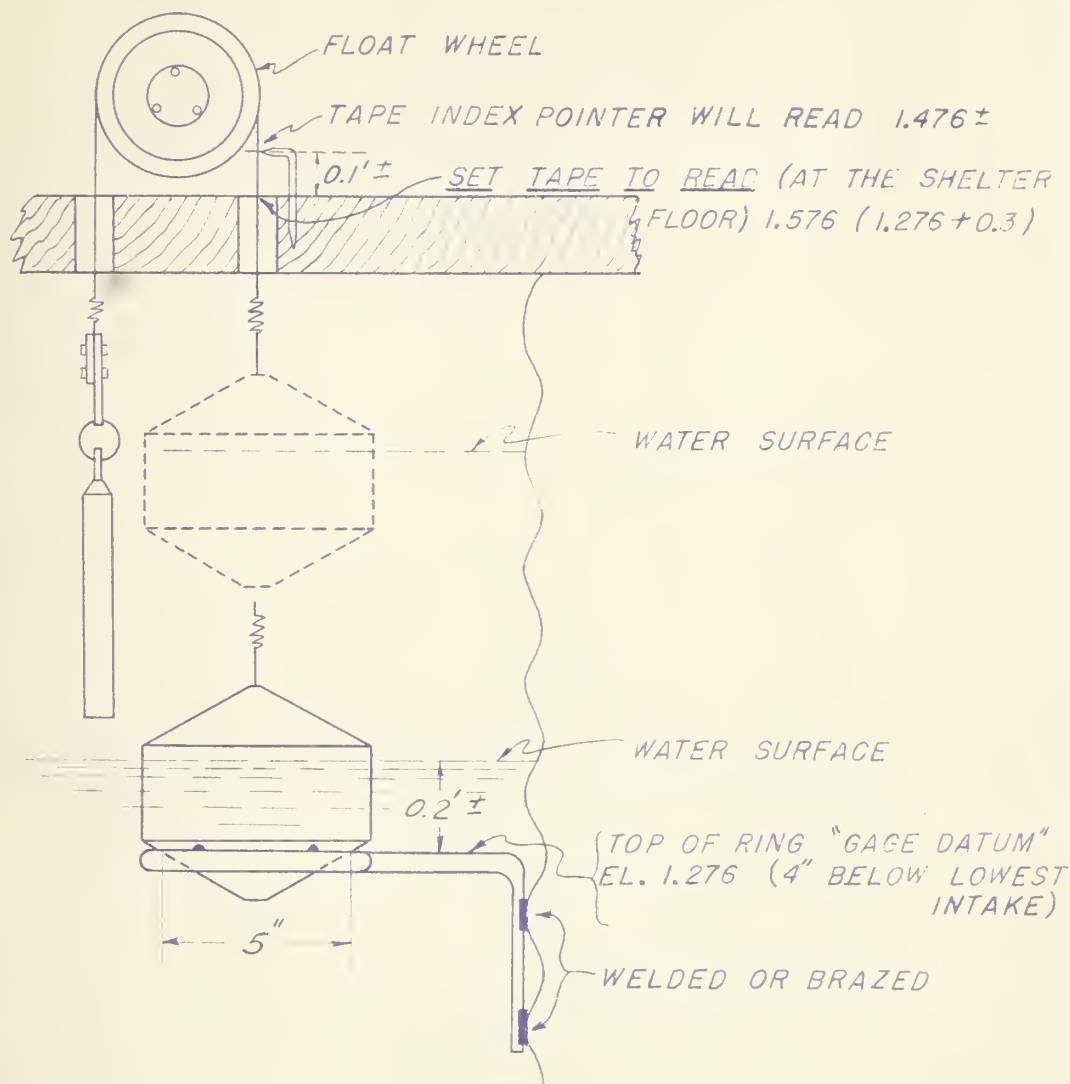
STEP 10. By rotating the float wheel raise the float from its rest and if necessary adjust the position of the recorder so that with the tape clearing the holes the float when lowered will come to rest on the three knobs of the float rest ring and when slowly raised it will not spin. If necessary enlarge the holes with a round file.

STEP 11. Mark the two screw holes of the recorder base; move recorder, drill base screw holes in the floor and attach recorder to shelter with two #8 $2\frac{1}{2}$ " brass round head screws.

CAUTION: Do not hammer on shelter floor with recorder or clock in the shelter.

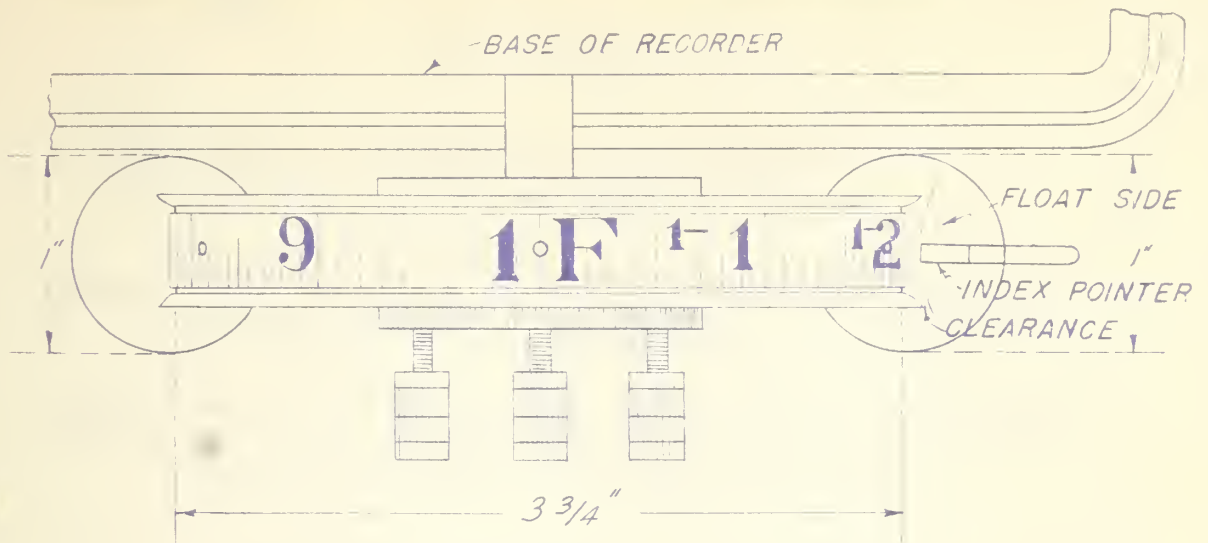
STEP 12: Screw brass pointer into shelter floor as shown on page 11.

(*) This elevation was determined in II, Step 4.

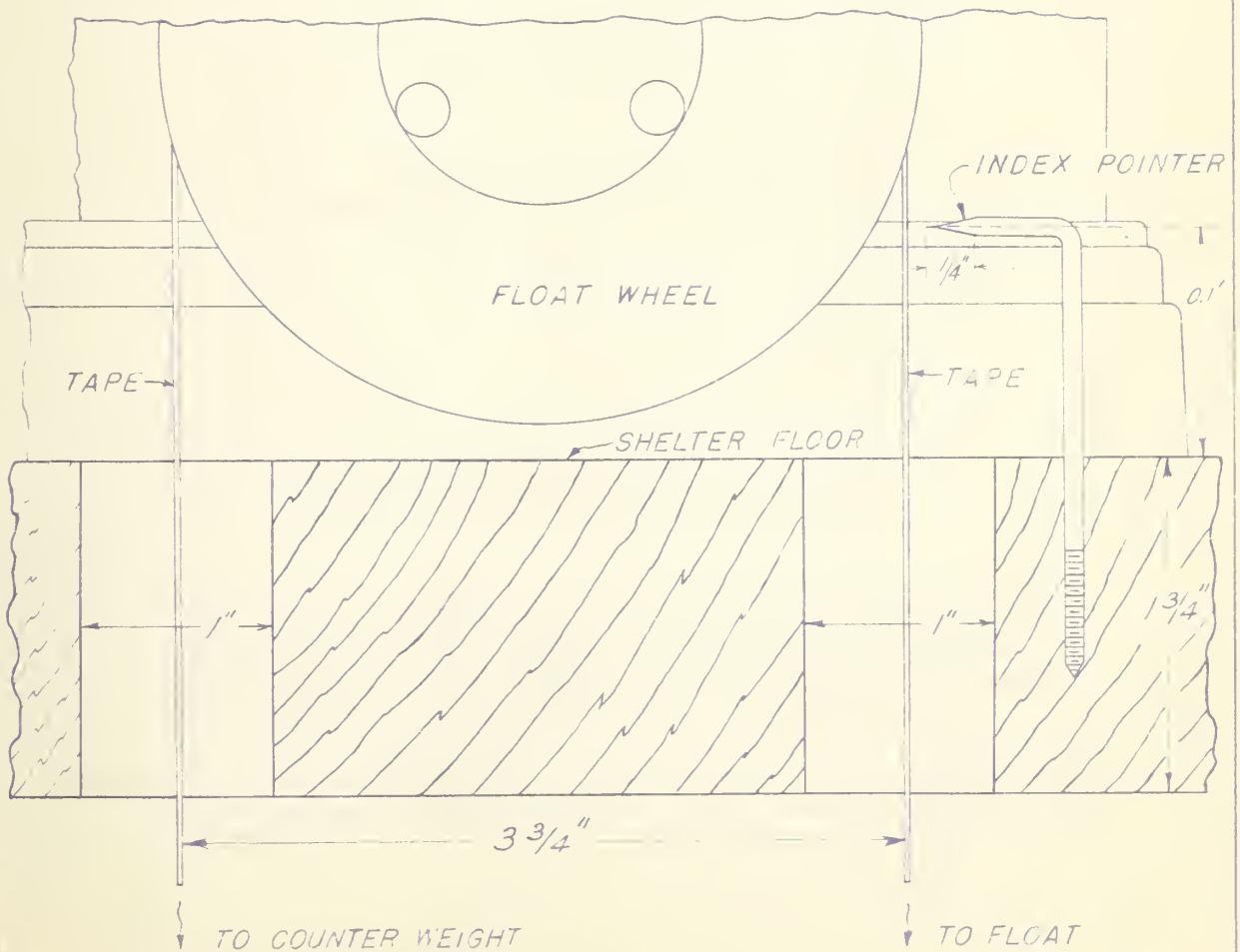


Note:-

Inasmuch as the line of floatation of the float is about 0.2' above the 5" inside diameter of the float rest ring and since the tape index pointer (brass hook) will be approximately 0.1' above the shelter floor it is necessary to set the tape as indicated in step 9 on page 9 in order that the index pointer will read the correct "gage datum elevations" of water surfaces.



PLAN



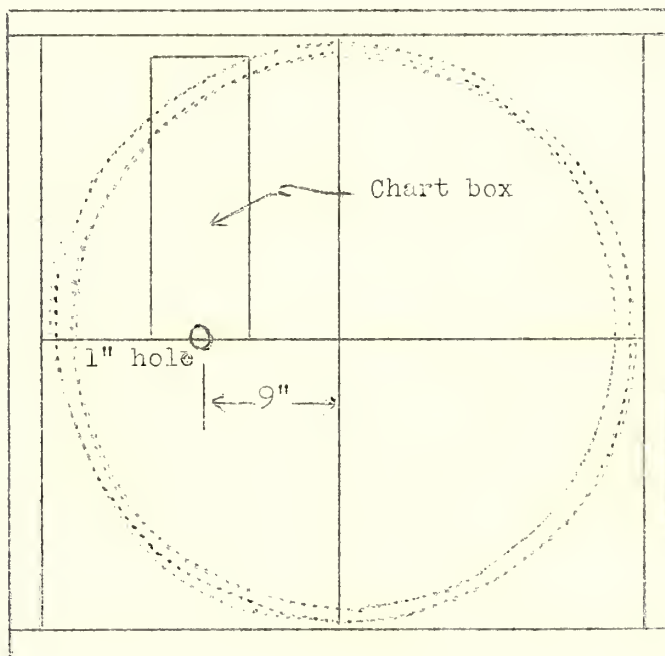
ELEVATION

SCALE-FULL SIZE

V. DETERMINATION OF CORRECT TAPE AND CHART READINGS
AND "GAGE DATUM ELEVATIONS" OF INTAKE PIPES

STEP 1. With the rubber hose add enough water to raise the float completely from its rest. Be sure no water is leaking out through the lowest intake pipe or its flange.

STEP 2. Bore a 1" hole through the shelter floor as shown below, so that a tape dropped through it may be seen from the level set up through the stilling well door.



Draw a horizontal line on one end of the chart box and place it across the center of this hole. Insert the graduated steel tape (not the float tape) through the hole and attach the plumb bob to its zero end.

STEP 3. With screws "E" of the recorder still loose, install clock, fill pen with ink and keep pen from chart by means of pen shifter.

STEP 4. With the rod held on the notch, check the H.I. of the level. Then set the point of the plumb bob suspended through the hole in the shelter floor at the H.I. Read the steel tape at the line on the cardboard box to 0.002'. Repeat this operation until two or more readings check to within 0.002'. Lower the plumb bob until the point just meets its reflection in the water and again read the steel tape at the line on the box. Repeat this operation until two or more readings check to within 0.002'.

The difference between these two readings subtracted from the H.I. of the level is the "gage datum elevation" of the water surface. (Example 1.542). Record this operation in the field book as shown on page 16.

CAUTION: Successively increasing readings of the tape with plumb bob at water surface elevation may indicate a leak in stilling well. Do not proceed any further before this is remedied.

STEP 5. Read the float tape index pointer (brass hook) and if necessary screw it in or out until it reads the elevation of the water surface obtained in Step #4 (within 0.002'). If the adjustment is too great shorten or lengthen the tape at the float clamp and make final adjustment with the tape index pointer. Repeat Step #4 to check water surface elevation. Make entry in the field book as shown on page 16.

STEP 6. By means of the pen shifter move the pen as close as possible to the clock cylinder without it touching the chart. Hold the float wheel and turn the knurled brass disk continuously in a counter-clockwise direction until the pen moves down through the lower reversal and up to the pointer reading obtained in Step 5. Turn the clock cylinder clockwise so the pen will indicate approximately correct time. Hold the float wheel so that the index pointer reads the same setting as made in Step 5. With the pen shifter place the pen on the chart. Turn the clock cylinder clockwise sufficiently for the pen to mark a line about $\frac{1}{2}$ " long. If this line agrees with the tape index pointer reading within 0.005' the screws "E" can be tightened, if not, bring the pen to the proper reading by turning the knurled brass disk slightly, again mark a line on the chart and if correct tighten screws "E". After screws "E" are tightened take hand off of the float wheel, rotate the clock cylinder again as above and check the chart line against the tape index pointer reading. Enter the pointer and chart readings under "W.S.i.p." and "W.S.ch. line" in the field book as shown on page 16. With the pen shifter move the pen from the chart.

STEP 7. With the rubber hose held below the water surface raise the water surface in the stilling well until the water just runs out of the channel end of the lowest intake pipe. Remove the hose. After the water ceases to run out of the pipe place the pen on the chart and rotate the clock cylinder slightly to mark a line on the chart. (This should be done when the water in the well is absolutely still.) Read this line and the tape index pointer. These readings should check within 0.005' and should be recorded in the field book under L.I.P. (or N.I.P., if the lowest intake pipe is at notch elevation) as shown on Page 16. Remove pen from chart.

NOTE: While waiting for the water to cease running out of the intake pipe, Step 1 of VI on page 15 can be performed.

In cases where the lowest intake pipe is not the notch intake pipe, the channel end of the lowest intake pipe should be capped and the above operation repeated for the notch intake pipe. The readings obtained should be recorded in the field book as shown on Page 16.

CAUTION: If in the case of the notch intake pipe the water surface in the stilling well (after the water ceases to run out of the channel end of the pipe) is higher than notch "Gage Datum Elevation" minus 0.05' the channel end of the pipe must be properly set by means of the bolt in the intake pipe support. (According to the stilling well design the intake pipes must be level and the inside bottom of the notch intake pipe should be 0.05' below the notch. If the inside bottom of the pipe is from 0.04' to 0.09' below the notch no change in the position of the pipe will be necessary.)

STEP 8. Bail out enough water from the stilling well to return the float to the float rest ring. By rotating the float wheel raise the float above the water surface while bailing out the water.

STEP 9. With the float resting on the float rest ring, place pen again on chart and rotate the clock to mark a line on the chart as in Step 6. If all operations outlined in V, Steps 1 to 7, were properly performed this line should now check the index pointer reading within 0.005'. Record these readings in the field book under "Float at Rest" as shown on Page 16. (If these readings do not agree the installation is incorrect and the above operations must be repeated.)

NOTE: The index pointer chart readings for "Float at Rest" are not the same as the "Gage Datum Elevation" of the Float Rest Ring.

STEP 10. Remove the chart from the clock cylinder and upon returning to the office complete all entries with black India ink as shown on the sample chart on Page 17. Make two identical copies. Send the original chart together with a set of carbons of field notes to Mr. C. E. Ramser, In Charge, Watershed and Hydrologic Studies, Soil Conservation Service, Washington, D. C., attention of Mr. D. B. Kringold, by Registered Mail. Place one of the remaining charts together with a set of notes in the instrument shelter. Retain the third chart with a set of notes in the Watershed Studies Project office file.

VI. BENCH MARK ELEVATIONS

STEP 1. Level the instrument and take foresights on the two permanent bench marks reading the target to within 0.001'. Repeat this operation until two observations check within 0.001'. Record these operations in the field book as shown on page 18. Use a T.P. if foresights cannot be read from the original set-up. The turning point should be a railroad spike driven in the ground or a similar permanent object. Describe the bench marks accurately and fully. In this connection and in all other instances refer to the banks of channel as right and left looking downstream rather than north, south, east or west.

UNITED STATES
DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
WATERSHED & HYDROLOGIC STUDIES
FIELD NOTES

PROJECT NO. Ohio-5 York, Ohio. STATION NO. W-I John Doe farm (ranch)
DATE: Nov. 11, 1937 WEATHER: 38°F. Clear Cloudy Rain Snow Windy Calm. OBSERVER: J. C. Smith
Mo. Day Year (Cross out words not applying) name

SITTING WATER STAGE RECORDER. FM. TYPE. SERIAL NO. 163-33.					"GAGE DATUM ELEVATIONS" OF INTAKE PIPES.	
V. DETERMINATION OF	CORRECT	TAPE AND CHART READINGS	DIFF. in Gage DATUM Elev.			
Sta.	BS.	H. I.	Tape Reading	Diff. in Tape Read.		
Notch	2.852	6.352			3.500	
P.B.			2.144			Plumb Bob Point held at H. I. - Tape read at line on chart box (V. Step 4).
P.B.			2.148	- check		"
P.B.			2.142			"
P.B. at V.S.			6.958			Plumb Bob Point at Water Surface when just meeting its reflection (V. Step 4).
P.B. at V.S.			6.952	- check		"
P.B. at W.S.			6.954			"
--				4.810		
*W. S.					1.542	Water Surface "Gage Datum Elev." (V. Step 4).
*W.S.i.p.					1.540	Setting of Tape Index Pointer for Water Surface Elevation (V. Steps 5 and 6).
W.S.ch.line					1.540	Water Surface Elevation Line on Recorder Chart (V. Step 6).
L.I.P.(i.p.)					1.609	Tape index pointer reading with water surface at inside bottom of lowest intake pipe (V. Step 7)
L.I.P.(ch. line)					1.610	Chart line reading with water surface as above (V. Step 7).
W.I.P.(i.p.)					3.450	Tape index pointer reading with water surface at inside bottom of intake pipe (V. Step 7)
W.I.P.(ch. line)					3.450	Chart line reading with water surface as above (V. Step 7).
Float at Rest					1.474	Tape index pointer reading with float on float rest (V. Step 9).
Float at Rest					1.475	Chart line reading with float on float rest (V. Step 9).

*Step 4 of V was repeated and water surface reading checked within 0.002'.

Page

Page

FIELD NOTES

John Doe farm

OBSERVER: J. C. Smith
NAME

VI.	BLANCHET	ELEVATIONS.				
Sta.	B.S.	I. I.	F.S.	Gage Datum elev.		
Notch	6.427	9.927		→ 3.500	(VI. Stop 1)	
T.P.	2.424	11.025	1.326	8.601	Railroad spike driven in ground.	
B.M. #1			4.521	→ 6.504	Press marker on left end of weir.	
B.M. #2			1.628	9.397	Press marker set in concrete just above ground level outside main gage enclosure in line with main gages & 4 ft. from Std. A.B. Gage.	
B.M. #2	1.628	11.025		9.397		
B.M. #1			4.522	→ 6.503		
T.P.	4.873	13.475	2.423	8.602		
Notch			9.976	→ 3.499		

INSTRUCTIONS
FOR THE
INSTALLATION, OPERATION AND CARE
OF THE
FRIEZ PORTABLE WATER LEVEL
RECORDER
MODEL FW-1

JULIEN P. FRIEZ & SONS, INC.

BALTIMORE

MARYLAND

GENERAL DESCRIPTION

Model FW-1 is a very compact, portable water level recorder designed particularly for use in well and ground water studies, irrigation projects and hydraulic laboratories and is adaptable to any similar installations. The water level record is made by a pen tracing the water level ordinate along the vertical arc of the record sheet. The recording drum is revolved by a clock movement to furnish the time coordinate, measured around the clock chart cylinder. The entire recording mechanism including the clock, is mounted on a light sturdy cast aluminum base provided with a hinged cover which completely encloses the recording mechanism when in operation. A hook latch and handle provide portability and a window adjacent to the clock cylinder allows full vision of the record pen.

The mechanism, including the float wheel mounted outside the cover, is designed to provide a ratio of five inches of chart equal to one foot of water and will record an unlimited water level change by multiple traverses of the pen actuated by a heart cam type of mechanism. Variable time scales are afforded by several available gear ratios as listed in a following table.

UNPACKING

The Recorder is packed separately from the clock and other accessories such as charts and ink. In unpacking the recorder, care should be exercised that the pen arm is untied carefully so as not to bend any of the transmitting mechanism. The float wheel "Q" is shipped on the recorder and is wedged tightly to prevent operation of the pen in transit. Remove packing from behind the float wheel and untie the pen arm which allows the pen arm follower pin "C" to follow the heart cam "H".

CAUTION During all of these operations any handling or tightening of the float wheel should be done by holding the float wheel shaft immediately behind its mounting bearing and in no case should the reversing mechanism be grasped to prevent turning of the float wheel while adjusting this latter piece.

The clock may now be unpacked together with its charts and ink and the recorder is ready for installation.

INSTALLATION

Clock

Install a chart on the clock cylinder in such a manner that time records progressively from left to right and the section for data (previously filled in at the operator's discretion) is under the opposite chart end. Clip the tightly wrapped chart in place with its seam under the chart clip. Wind the clock, using the same care accorded any good domestic clock; i.e. stop before applying excess force to further tense the spring. Lift the pen arm to its outermost position by turning pen shifter "B", install the clock

chart cylinder "A" on the clock shaft by merely sliding it on until its pinion meshes with the gear at the base of the shaft. Top clock bearing in this case is on a pivot plate at the upper end of the shaft.

CAUTION Never carry the Recorder upside down with the clock on the shaft, as this will probably cause breakage of the clock and perhaps some other part of the mechanism.

Floats

Loosen screws "E" allowing float wheel "Q" to revolve freely on its shaft. Install the float tape so that holes in the tape mesh with the sprocket lugs on the float wheel. Attach the float to one end of the tape and lower it to the surface of the water. Attach the float counter-weight on the other end of the desired length of float tape as described in the next paragraph.

Tape Clamps

The float and its counter-weight are attached to tape clamps by a ring "G" which operates exactly as a key ring. The clamps "F" are then used to attach the float and its counter-weight to either extremity of the perforated float tape as illustrated. Clamps are provided with two screws which when slightly loosened allow insertion of the tape. Tightening of the clamps at the desired tape length completes the operation. Lower the float to the water on the freely turning float wheel.

With the float resting on the still surface of the water level to be recorded, tighten float clamp screws "E" evenly to insure firm bearing of the float wheel. If it is desired to anchor the recorder firmly in position, screw or bolt attachment is made through holes "D".

OPERATION

General

Set the pen to a water level ordinate designated as a datum line and to time by revolving the clock slowly in the same direction that it is normally turned by its own spring wound mechanism. The pen is inked by inserting a globule of ink from the end of the inserter furnished with each bottle of ink. Be certain that the proper gear and pinion for the time scale desired are in mesh below the clock and that the clock is resting firmly on its bearing plate.

Clock Gear Changes

If it is desired to change to another time scale than that shipped with the recorder, the following procedure should be adopted:

Remove the clock from its bearing shaft. Remove the entire clock shaft by loosening the wing nut below the recorder base and lifting vertically. Install the proper clock gear on the clock shaft, noting that the spacer washer is replaced below it. Numbers are stamped on each gear as shown in the table below. The properly marked pinion - also listed in the table below - should be mounted on the clock itself. Shafts marked "Daily" and "Weekly" protrude from the base of the clock. The pinion designed for mounting on either of these shafts has a friction fit split sleeve collar which fits over the shaft with the split sleeve collar inward, after which the small washer and pin are reinstalled as a safety retainer only. The actual driving force of the clock is transmitted by the friction of the sleeve on the pinion shaft. This can be adjusted by closing the clamp with a pair of plyers before finally pressing it on the shaft.

TABLE FOR CLOCK GEAR AND PINION INSTALLATION

MODEL	CHART	TIME PER CLOCK REVOLUTION	GEAR AND PINION NUMBER	PLACE PINION ON SHAFT MARKED
FW-1	1940	6 hour	6	"Daily"
FW-1	1940	12 hour	12	"Daily"
FW-1	1940	24 hour	24	"Daily"
FW-1	1941	8 hour	8	"Daily"
FW-1	1941	4 day	96	"Weekly"
FW-1	1941	8 day	192	"Weekly"

CARE

Pen Reversing Adjustment

The reversing mechanism is designed so that with pin "C" in the heart cam depression the pen registers at the lower recording edge of the chart. A reversal will occur at the top recording edge of the chart when the pin reaches the heart peak. The recorder is shipped in this condition, but if by any chance slight variation in chart installation requires adjusting, this is accomplished by moving screw "K", the amount necessary to make the above conditions occur at the proper point.

CAUTION All other lock nuts and screws except the counter-weight thumb screw "M" are a part of the recorder calibration and should never be loosened except for complete recalibration by one thoroughly familiar with the necessary details. Normally, calibration must be made at the factory.

Cleaning

If the recorder needs cleaning, the following procedure may be adopted. Remove the nut at the rear end of the float wheel shaft. The entire float wheel may be removed by slipping gear "N" from the shaft as the latter is removed from the bearing in casting "P". To remove the pen arm mechanism complete, loosen screws "J" and remove it from its end pivots carefully. The heart cam mechanism can be removed in a similar manner. All of these parts may then be dipped in gasoline for thorough cleaning. Reinstall them very carefully taking care that too much end pressure is not applied to the pivots. Gear No. "N" on the float wheel shaft is a friction fit. If any difficulty is encountered in meshing gear "N" with gear "I" loosen the screw opposite "O" and tighten "O" which will raise pen operating mechanism slightly and allow free mesh. Retightening of the screws described above will complete the reinstallation.

Oiling

Bearings, gears and pivot points should be oiled with a good grade of clock oil very sparingly by applying the amount of oil that is retained on the end of a fine wire to the bearing points.

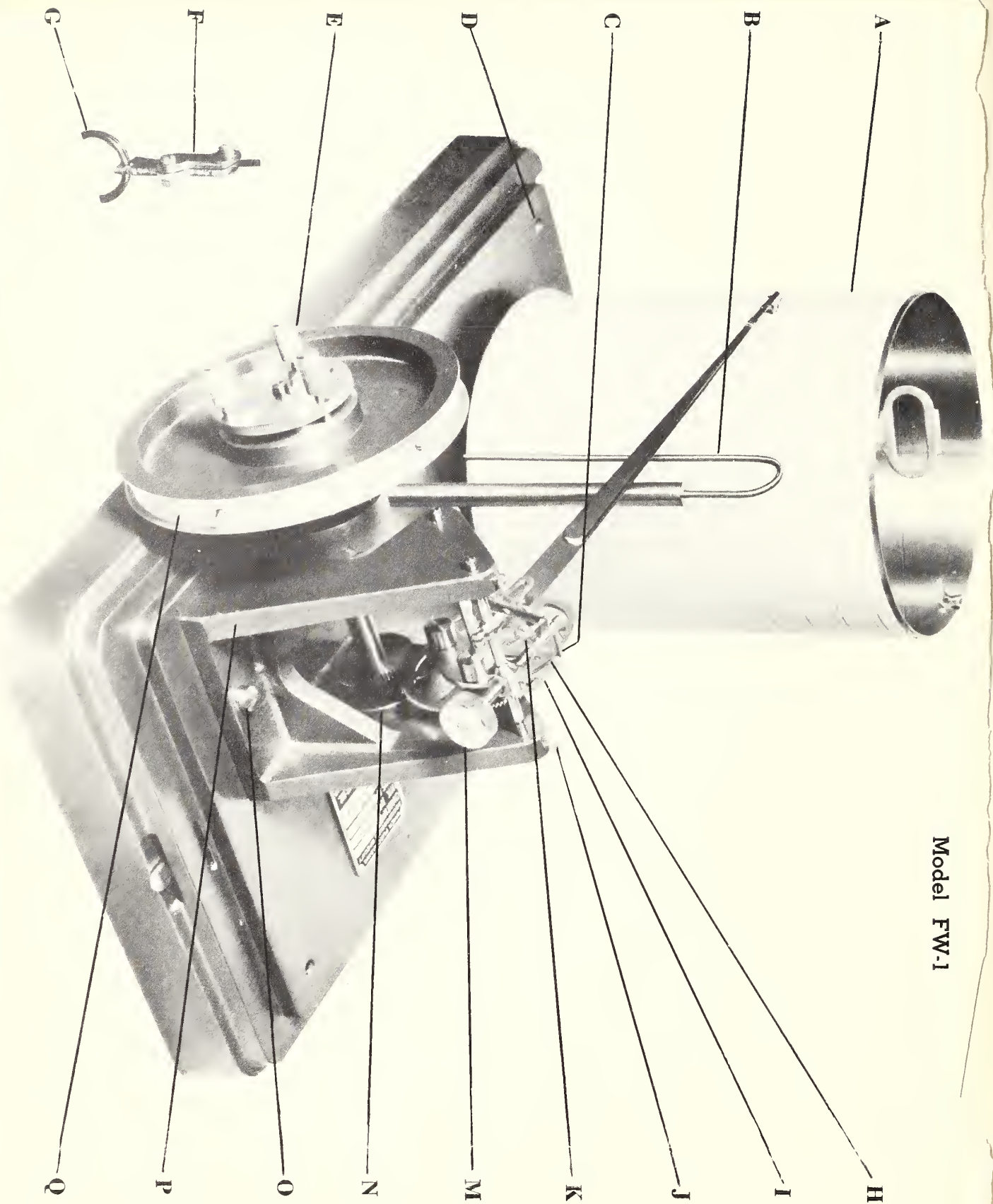
Clock

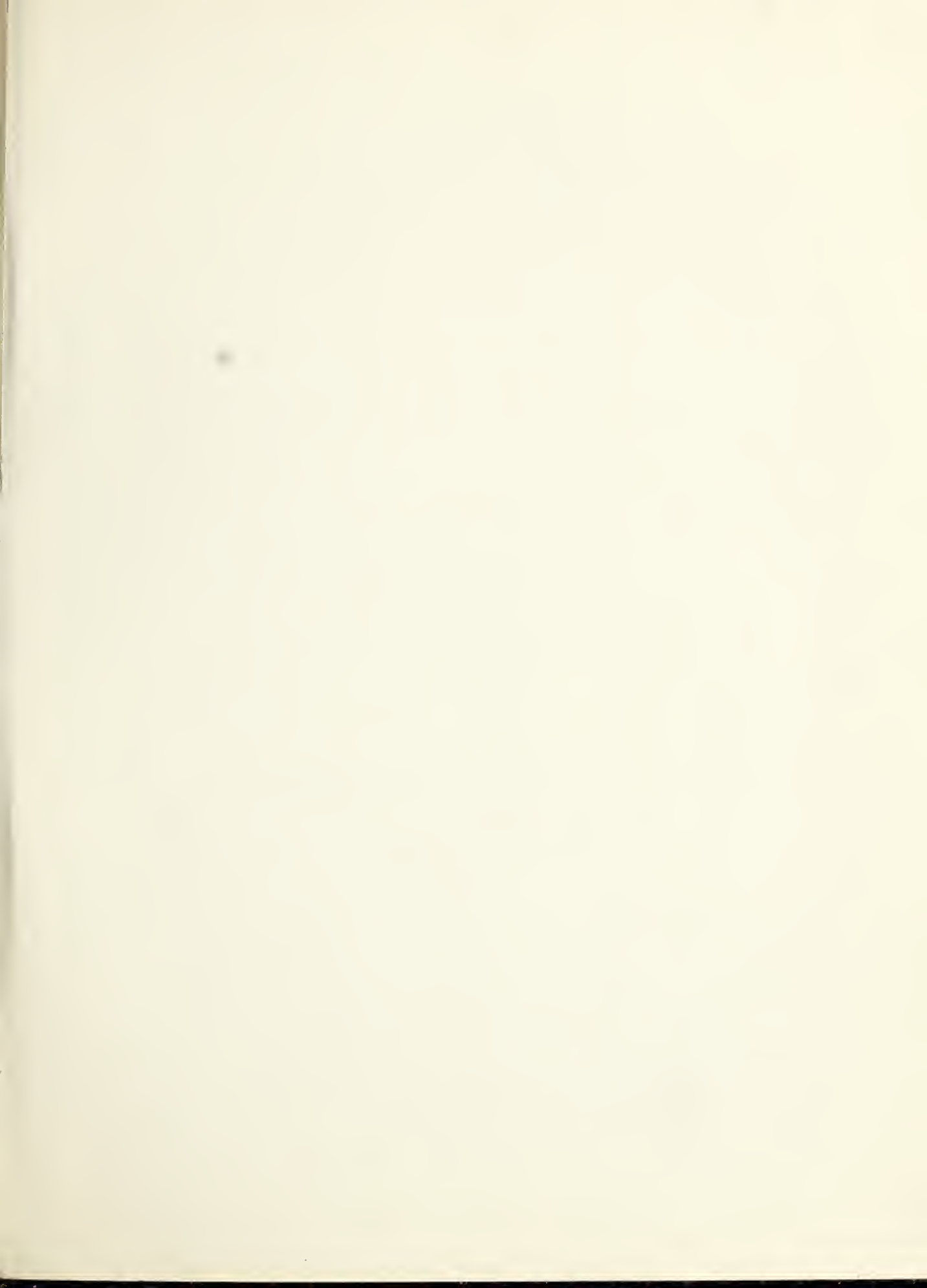
The clock should be returned to the factory for cleaning, oiling and timing periodically. When the clock is returned to the factory for cleaning, oiling and timing or other adjustment, return it complete with shaft and gears. In no case should this mechanism be cleaned by any other than an expert jeweler or watch maker.

Transport

When the recorder is to be transported, floats and counter-weights are first removed, after which the pen arm should be tightened and the float wheel wedged tightly in the same manner as when received from the factory. It is advisable to remove ink from pens if there is any possibility of jarring with consequent ink spattering. In all cases where it is desired to retain the float wheel & gear, care should be taken that retention of the float wheel be made directly behind it and that no force is applied to the reversing mechanism in order to hold the float wheel.

Model FW-1





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